**Amendments to the Claims**:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. - 12. (Cancelled)

13. (Currently Amended) An illumination optical device for illuminating an irradiated plane with light from a light source supplying pulse laser light, comprising:

a diffractive optical element arranged in an optical path between the light source and the irradiated plane, wherein

an optical material forming the diffractive optical element includes an oxide crystal material, an optic axis of the oxide crystal material is set approximately parallel to an optical axis of the illumination optical device; and

the diffractive optical element has a surface shape formed on the oxide crystal material.

14. (Previously Presented) The illumination optical device according to claim 13, wherein the diffractive optical element is arranged in the optical path between the light source and the irradiated plane, through which a light beam passes having an energy density of 1 $mJ/cm^2$/pulse or more.

15. (Previously Presented) The illumination optical device according to claim 13, wherein the oxide crystal material is one of quartz crystal ($SiO_2$), barium titanate ($BaTiO_3$), titanium trioxide ($TiO_3$), magnesium oxide (MgO), and sapphire ($Al_2O_3$).

16. (Cancelled)

17. (Currently Amended) The illumination optical device according to ~~claim 16~~ claim 15, wherein the surface shape of the diffractive optical element is formed by dry etching.

18. (Previously Presented) The illumination optical device according to claim 13, wherein the diffractive optical element transforms an incident light beam into a light beam having a given light intensity distribution.

19. (Previously Presented) The illumination optical device according to claim 13, further comprising:

an optical integrator for forming a secondary light source in a given shape on an illumination pupil plane based on a light beam passing through the diffractive optical element.

20. (Cancelled)

21. (Currently Amended) The illumination optical device according to ~~claim 20~~ claim 13, wherein

the oxide crystal material comprises a plurality of optic axes, and wherein

one of the plurality of optic axes is set approximately parallel to the optical axis of the illumination optical device.

22. - 23. (Cancelled)

24. (Previously Presented) A photolithography machine, comprising:

the illumination optical device according to claim 13; and

a projection optical system for projecting and exposing a pattern of a mask arranged on the irradiated plane on a photosensitive substrate.

25. (Previously Presented) An exposure method, comprising the steps of:

illuminating a mask through the illumination optical device according to claim 13; and

projecting and exposing an image of a pattern formed on the illuminated mask on a photosensitive substrate.

26. - 38. (Cancelled)

39. (Previously Presented) The illumination optical device according to claim 13, wherein the diffractive optical element is arranged in the optical path between the light source and the irradiated plane, through which a light beam passes having an energy density of 10 $mJ/cm^2$/pulse or more.

40. (Currently Amended) A diffractive optical element for transforming an input pulse laser beam into a radiation beam having a predetermined sectional shape, comprising:

a radiation transparent member made of an oxide crystal material, an optic axis of the oxide crystal material is set approximately parallel to a propagation direction of the input laser beam; and

a surface shape formed on the oxide crystal material of the radiation transparent member,

wherein the input pulse laser beam is diffracted by the surface shape formed on the oxide crystal material.

41. (Previously Presented) The diffractive optical element according to claim 40, wherein the surface shape of the oxide crystal material is formed by dry etching.

42. (Previously Presented) The diffractive optical element according to claim 41, wherein the diffracted input laser beam diffracted by the surface shape forms the predetermined sectional shape.

43. (Cancelled)

44. (Currently Amended) The diffractive optical element according to ~~claim 43~~ claim 40, wherein the diffracted input laser beam diffracted by the surface shape forms the predetermined sectional shape.

45. (Cancelled)

46. (Previously Presented) The diffractive optical element according to claim 40, wherein the oxide crystal material is one of quartz crystal ($SiO_2$), barium titanate ($BaTiO_3$), titanium trioxide ($TiO_3$), magnesium oxide (MgO), and sapphire ($Al_2O_3$).

47. (Currently Amended) A method of manufacturing a diffractive optical element for transforming an input pulse laser beam into a radiation beam having a predetermined sectional shape, comprising:

preparing a radiation transparent member made of an oxide crystal material;

setting an optic axis of the oxide crystal material approximately parallel to a propagation direction of the input pulse laser beam; and

forming a surface shape on the oxide crystal material of the radiation transparent member, wherein the surface shape diffracts the input pulse laser beam.

48. (Previously Presented) The method according to claim 47, wherein the surface shape of the oxide crystal material is formed by dry etching.

49. (Cancelled)

50. (Currently Amended) The method according to ~~claim 49~~ claim 47, wherein the oxide crystal material is one of quartz crystal ($SiO_2$), barium titanate ($BaTiO_3$), titanium trioxide ($TiO_3$), magnesium oxide (MgO), and sapphire ($Al_2O_3$).

51. (Previously Presented) The method according to claim 50, wherein the diffracted input laser beam diffracted by the surface shape forms the predetermined sectional shape.

52. (Previously Presented) The diffractive optical element formed by the method according to claim 47.